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## NOTES ON *HETEROPOGON VESPOIDES* BIGOT AND OTHER ASILIDAE

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*Heteropogon vespooides* was described in 1878 by Bigot from a single male specimen. The rather indefinite type-locality was given merely as California, as was often the practice in those days. The description was written in French, Bigot's native language. However, an excellent translation was made by Back (Trans. Amer. Ent. Soc. 35:329, 1909) who appended thereto a note to the effect that he did not believe that this species was known to recent collectors. Until the summer of 1924 no other specimens were reported. Then L. S. Slevin captured a specimen, in Monterey County, California, that was believed to be a female and which is now in the collection of the California Academy of Sciences at San Francisco. Unfortunately, its characters were much obscured by having become badly greased. It was described as well as possible by Wilcox (Bull. Brook. Ent. Soc. 36:52, 1941).

It is of interest here to mention that I am in receipt of a note from Mr. Wilcox stating that the species is not a true *Heteropogon* and seems to be most closely allied to *Callinicus*. But it does not have the pair of inwardly directed spurs at the tip of the middle tibiae characteristic of that genus. Mr. Wilcox also states that its habits, which I recently observed and discussed with him, are unlike those of other *Heteropogon*, which perch on the tips of twigs waiting for their prey to come along, then dart out after it and frequently return to the same perch. My observations of considerable numbers of these insects in August, 1941, record the following facts in that connection. Finding them almost continually on the wing, they were very difficult of capture, constantly circling or cruising at heights from six to twenty feet above the ground. The victims, which were mostly large flies, were seized at the conclusion of lightning-like dives from above while the prey was in flight. After the capture, the prey was carried some distance to a convenient bare spot on the ground where consumption was effected. There were no twigs or perches to rest upon in the locality even had the Asilidae so been inclined; only the close-to-the-ground vegetation so often seen near the sea.

This colony was located some seventy-five miles north of San Francisco and between the mouth of the Russian River and that of the Salmon, on the Sonoma County coast. Here steep cliffs overhang the sea and many promontories, flat on top, project seaward. This is the home of *Heteropogon vespooides*. This Sonoma County locality rewarded the writer with a substantial number of specimens.

In appearance *H. vespooides*, with its black and yellow striped abdomen, is a very impressive appearing insect superficially resembling the wasps of the "yellow jacket" group. It could easily be mistaken for such until close examination could be made. It is one of the remarkable mimics that nature has evolved that are so strikingly illustrated in various Asilidae. Other amazing examples are the likeness of *Asilus midas* Brauer (Arizona) to the wasp *Pepsis formosa* Say (the tarantula hawk), *Bombomima fernaldi* Back to the bumble bee, *Bombus gelidus* Cresson, recently found by this writer in New Mexico, and *Bombomima californica* Banks to the bumble bee, *Bombus vosnesenskii* Rad. seen in northern California. It has been the writers good fortune to have secured excellent examples of these, and they constitute a very unusual display.

ON THE NEARCTIC SPECIES OF MOTES  
(HYMENOPTERA, SPHECIDAE)

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The dominant genus of Larvine wasps in warm countries throughout the world is *Motes* Kohl (olim *Notogonia* Costa seu *Notogonidea* Rohwer), but it is rather poorly represented in the Nearctic fauna. Hitherto only five species have been recorded from the United States: *argentatus* (Palisot de Beauvois), 1811, *nequalis* (Fox), 1893, *nigripennis* (Fox), 1893, *occidentalis* (Viereck), 1902, and *subaequalis* (Rohwer) 1909. To this roster may now be added the following two very distinctive southern forms.

***Motes mescalero* \* n. sp.**

The clear hyaline wings and the striking and curious conformation of the apical abdominal sternites of the male readily differentiate *mescalero* from all other described Nearctic *Motes*.

*Type.* ♂; Alamogordo, Otero County, New Mexico. Elevation, 4320-4600 feet. May 15, 1902. (Henry L. Viereck.)

*Male.* 8.5 mm. long. Opaque black throughout. Palpi and tarsi apically, sordid fulvous. Mandibular apices and scapes anteriorly, piceous. Wings iridescent, clear hyaline save for a very slight infumation in appendiculate cell and narrowly along anterior border of marginal cell; stigma and veins light brunneous.

Entire insect with a thin vestiture of appressed silvery puberulent pile throughout. Head and thorax with fine granular puncturation throughout.

*Head:* Clypeus with median length one-fourth the vertical eye length; disc gently tumid, not keeled; median lobe with apical margin gently rounded out and with a narrow, transverse, glabrous, nitidous pre-apical band. Antennae with scapes subfusciform, weakly keeled lengthwise anteriorly, one-half the vertical eye length; flagellum with second to sixth articles inconspicuously narrowed medially, first segment obtuse, the last terete, remainder cylindrical, every segment but first and last with a distinct tyloides running lengthwise both above and below; relative length of pedicel and flagellar articles as follows: pedicel 9; flagellar article one 14, two 16, three 16, four 17, five 15, ten 12, eleven 15; interantennal line about three-eights (.385) the antennocular distance. Interocular space at vertex subequal in length to the scape.

*Thorax* with fine subgranular puncturation throughout. Mesopleura neither rugose nor striate; episternal suture distinct; episternali faint. Propodeum finely granulate throughout; dorsal face neither rugulose nor bisected by a carinule, and not separated from posterior face by a carinule; posterior face bisected by a fine linear sulcus, laterad of which the surface is provided with a few slightly arcuate, parallel, horizontal wrinkles; lateral faces simple.

Fore and middle femora broadly and shallowly emarginate at base beneath for about half their length; hind femora shallowly, flatly excavate beneath from a little beyond base almost to apex. Hind tibiae with a weak keel lengthwise; longer calcar three-fourths the length of hind metatarsus.

Fore wings with the abscissae of radius as follows: first 7, second 2, third 4, fourth 7, fifth 3; and of cubitus: first 21, second 3, third 1, fourth 7, fifth 10.

*Abdomen:* First four tergites with broad, silvery, tessellate, pubescent apical fasciae; ultimate tergite subtrigonal, the apex not appreciably truncate and not provided with latero-apical spines. Sternites: second elongate, strongly convex; third and fourth flatly concave, their apical margins entire; fifth flat, the disc with a brush of dark aeneous hair, apical margin arcuately emarginate on each side of median line, medially with an acute median process; sixth with a deep U-shaped emargination on each side of median line, leaving an elongate acuminate, linguiform, backward projecting process which is clothed with a brush of dark aeneous hair, the process three-tenths the length of hind metatarsi; seventh flat, apical mar-

\*After the Mescalero Apache Indians of New Mexico.

gin broadly, shallowly, arcuately emarginate; eighth flat, broadly linguiform, the apex entire and gently rounded out.

*Female.* Unknown.

Only the unique male of this Lower Sonoran form is known at present.

**Motes muspa\*** n. sp.

The superficial habitus of *muspa* is very similar to that of the common widespread Nearctic *argentatus*, but the entire, non-emarginate middle femora readily separate it from that form. The strongly keeled clypeus and the abruptly flattened under side of the hind femora immediately distinguish *muspa* from all of its North American congeners.

Type ♂; Miakha River State Park, Sarasota County, Florida. February 18, 1937.

*Male.* 10 mm. long. Subopaque black throughout. Apical half of mandibles piceous. Hind tibiae beneath at apex and hypopygium, sordid fulvous. Wings iridescent, hyaline, with a very light and uniform tint of infumation throughout, the apical margins of fore and hind wings with a broad, more deeply infumated border.

Entire insect with a thin vestiture of appressed silvery puberulent pile throughout. Head and thorax with a very fine granular puncturation.

Head: Clypeus with median length one-fourth the vertical eye length; flat laterally, disc gently tumid and bisected on distal two-thirds by a rather sharp nitidous keel; median lobe with apical margin gently rounded out and with a narrow, transverse, glabrous, nitidous band. Antennae with scapes weakly keeled lengthwise anteriorly, one-half the vertical eye length; pedicel obtetere; flagellum with first six segments cylindrical-subpanduriform, remainder except last cylindrical, ultimate article terete, each segment with a sharp and distinct tyloides running lengthwise both above and below; relative lengths of pedicel and flagellar articles as follows: pedicel 8; flagellar article one 13, two 17, three 18, four 19, five 17, six 16, ten 13, eleven 16; interantennal line one-half the antennocular distance. Interocular space at vertex one-third the vertical eye length, or almost seven-tenths (.684) the length of scape.

Thorax with fine subgranular puncturation throughout. Mesonotum with three fine, parallel impressed lines on anterior third. Mesopleura not rugulose; episternal suture strong, sharp, and finely foveolate; episternali faint. Pro-podeum granulate throughout, the granulation of dorsal face coarser than that of posterior and lateral faces; dorsal face bisected on anterior two-thirds by a longitudinal carinule, and laterally from spiracles to posterior margin with short, parallel, transverse wrinkles, the posterior margin edged by a sharp arcuate carinule which is broken medially on each side; posterior face bisected by a fine but deep impression, otherwise simple; lateral faces simple.

Fore and middle femora fusiform and entire, not emarginate basally beneath. Hind femora subfusiform, strongly and abruptly flattened below from base almost to apex, the flattened portion margined by subtrenchant edges. Hind tibiae with a weak keel lengthwise on outer faces; longer calcar nine-tenths the length of hind metatarsi.

Fore wings with abscissae of radius as follows: first 15, second 5, third 10, fourth 25, fifth 8; and of cubitus: first 55, second 6, third 3, fourth 11, fifth 25.

Abdomen with first four tergites with broad, silvery, tessellate, pubescent apical fasciae. Ultimate tergite subtrapeziform, with apex broadly and squarely truncate, each latero-apical angle with a small spine. Second sternite elongate, strongly convex, apical margin truncate; third to sixth sternites with apical margins entire but gently arcuately concave; third with disc flattened and subglabrous; fourth to sixth with disc gently concave and subglabrous; seventh with disc convex, apical margin subtruncate; hypopygium subquadrate, flat, apex

\*After the Muspa Indians of southern Florida.

gently and roundly emarginate; lateral portions of fifth and sixth, and entire seventh sternite with a thin brush of suberect puberulent, dark aeneous hair.

*Female.* Unknown.

*Specimens examined.* In addition to the type, I have examined a topotypic, equidistant male (paratype) which agrees with the type in all essential details.

#### NOTES ON THE DOGWOOD FRUIT FLY, A RACE OF *RHAGOLETIS POMONELLA* (WALSH)

In the 69th Annual Report of the Entomological Society of Ontario (1938), pages 56 and 57, the writer compares the *Rhagoletis* reared from dogwood (*Cornus Amomum* Mill.) with the morphologically similar apple maggot from apple and hawthorn. Notes on the life history are given together with some experimental data which indicates that under insectary conditions the dogwood fruit fly would not oviposit in apples, nor interbreed with flies reared from apple or hawthorn. It then appeared to the writer that the flies which infested the three different hosts had originated from a single species but had become segregated into groups with more or less definite host preferences.

During 1939 to 1942 inclusive, studies of the host relationships of the dogwood fruit fly and experiments in cross-breeding flies from the three hosts were continued in the insectary and field. Approximately 2500 adult dogwood fruit flies and a proportionate number of apple and hawthorn flies were used in the experiments. In the insectary, potted dogwood seedlings (without fruit) were placed in the rearing cages to allow the flies to feed on the leaves and to make accessible any natural stimuli which the plant might offer. In the field the flies were confined in wirecloth cages on apple, hawthorn and dogwood branches, both with and without fruit. Water was supplied in all cages by wicks in small jars of water, and a diet, consisting of sugar 4 parts, yeast cake 1 part, and proteose-peptone 1 part, was available at all times. The flies were transferred to the cages within 24 hours after emergence from the soil. The cages in the insectary were examined at least once daily and those in the field three times each week until the flies died, usually between mid-July and early September. Many of the flies lived from four to six weeks, remaining active and showing no detrimental effects from confinement.

In the cross-breeding experiments, males from dogwood were confined with females from apple and hawthorn, and females from dogwood with males from the other two hosts. Although mating among dogwood flies was observed at almost every inspection in the host study cages described later, it was never seen to take place between dogwood flies and those from apple or hawthorn in the cross-breeding cages, and in the latter no fertile eggs were deposited, although apple, hawthorn and dogwood fruits were regularly supplied.

In the host study cages, dogwood flies of both sexes were confined with apple, hawthorn or dogwood fruits, the various fruits being placed alone in some cages and in combination or alternation in others. The flies laid an abundance of fertile eggs in dogwood fruit but made no punctures and laid no eggs in either apple or hawthorn fruits.

The experimental evidence gained over the period from 1937 to 1942 inclusive indicates that the dogwood fruit fly or maggot is a distinct biological race of *Rhagoletis pomonella* which will not interbreed with the race from apple and hawthorn nor accept these fruits as hosts.

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A THIRD TENT CATERPILLAR IN EASTERN CANADA  
(LEPIDOPTERA, LASIOCAMPIDAE) \*

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Everyone who travels the forests or roads of Ontario and the provinces east of it must be familiar with the tent caterpillars of the genus *Malacosoma*. The best known of these is the orchard, eastern, or American tent caterpillar, *Malacosoma americana* Fab., which makes its large grey "tents" on chokecherry, apple, hawthorn, wild plum and other trees and shrubs, chiefly of the family Rosaceae. More familiar to anglers and bushmen as well as to townsmen in "poplar country" is the forest tent caterpillar, *Malacosoma disstria* Hubn., which breeds chiefly on aspen but which will eat the leaves of practically all broad-leaved trees, shrubs and bushes except red maple and a few shrubs which seem to be consistently avoided. Even such unlike plants as white spruce and wild strawberry are eaten, while the blueberry crop is sometimes ruined by defoliation of the bushes by the larvae. This species is sometimes wrongly called the armyworm, and is notorious because it "stops the trains" when it occurs in outbreak numbers.

A third species is now common in certain districts of Ontario and Quebec; this is *Malacosoma pluvialis* Dyar, usually known as the western tent caterpillar. It has been known for years from western Canada but has only recently been noted in Ontario and Quebec. Whether it has been brought east by railway cars or some other vehicles; whether it has been carried by wind or storms; or whether it has been in the northern forests indefinitely will always be an open question, but certain details in its habits and life history indicate that it is probably an immigrant from a country less densely covered with bush than is the habitat now being considered.

My first sight of this interesting species was in June, 1937, near the entomological field station at Laniel, Que. A spot of brilliant orange on a young cherry tree attracted attention; investigation showed it to be a cluster of half-grown *Malacosoma* larvae resting on their tent, but the brilliant colouring showed that it could be neither *disstria* nor *americana*. Other colonies were found soon after and numerous adults secured, which were eventually sent to Ottawa and identified by Dr. J. McDunnough as *Malacosoma pluvialis* Dyar.

Although no special study of the species has been made, observations from time to time have now supplied the main details of its life history, which is here briefly outlined for the benefit of anyone whose interest may be aroused by this striking larva.

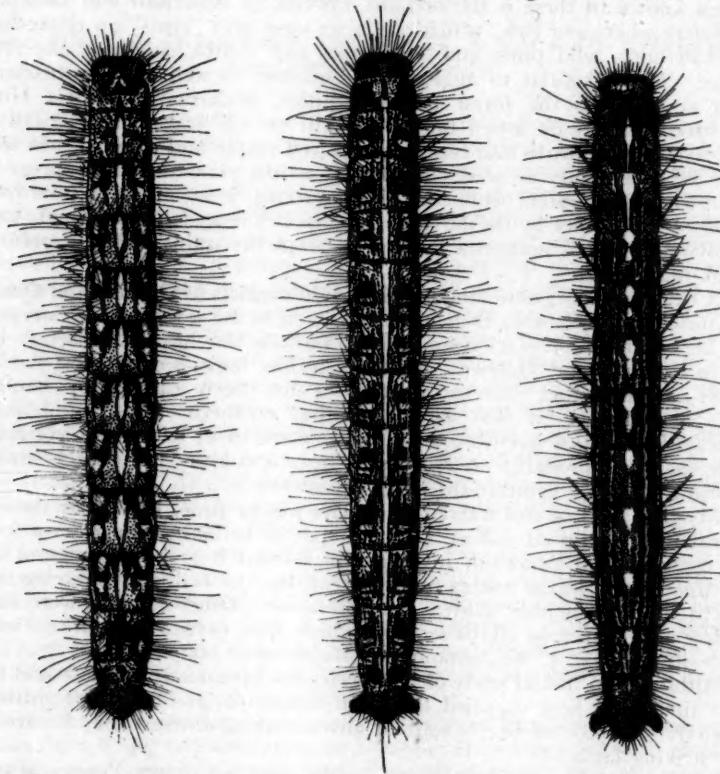
The favoured hosts of this insect are the wild red cherry, *Prunus pensylvanica* L. f., the white birch *Betula papyrifera* Marsh and a small *Salix* found growing in association with these; other shrubs may occasionally be eaten by the larvae when lack of food compels them to leave their original nest.

Eggs appear to be laid almost without exception on cherry; several hundred egg-clusters have been found at one time or another on this shrub but very few on birch and none on willow. However, apparently not every cherry tree is considered suitable for oviposition. The favourite type is a shrub about one-half to one inch in diameter at the base, four to six feet high, and growing in the open, unshaded by larger trees and uncrowded by others of its own size. Such shrubs are found in large numbers as coppice growth along railroads and highways, in fence rows, and in other places where the bushes are cut every few years to keep them from getting too high; similar ones, much older and of slower growth, but of the same size, occur on the rocky lake shores and barren ridges of the northern bush, and these shrubs also support colonies of the larvae. Practically none is found in the dense tangle which springs up after forest fires al-

\*Contribution No. 2219, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

though cherry is often one of the principal constituents in this type of growth. It would appear that the insect finds such situations too shaded. This may indicate that it is an immigrant from more open country.

The egg-masses are usually laid within a foot of the ground and always consist of a flat patch, never encircling the twig as the hollow masses of the other two species of *Malacosoma* usually do. About one hundred eggs are commonly present in an average mass, some masses being much larger than others.



*Malacosoma  
pluvialis*

*M. americana*

*M. disstria*

The larvae hatch when the young cherry leaves are unfolding, immediately spin a tent in a nearby crotch of the bush, and begin to feed after the manner of *M. americana*, which they resemble in general habits. As soon as the nest becomes crowded or foliage gets scarce, a new tent is made on a nearby bush. It is at this stage that many nests are made on birch and willow instead of cherry. Feeding is voracious, and several clumps of shrubs may be practically defoliated before it is completed.

When nearly full grown the larvae develop a wandering habit, and most of them leave the tent to crawl around over nearby shrubs, still apparently feeding. Soon after this stage, they begin to look for places in which to spin cocoons and may be seen on stumps, logs, rocks, bits of bark and other debris. Probably most of the cocoons are spun under such objects; they are extremely hard to find but a few have been taken from under dead roots and pieces of stump where they appeared to be well protected from most enemies.

The larvae resemble those of *M. americana* in general appearance but may be distinguished by the more definite interruptions in the dorsal stripe and by the large and brilliantly orange subdorsal stripes which give them a very striking appearance.

Adults emerge at about the same time as those of the forest tent caterpillar, in mid-July at Laniel. They also resemble *M. americana* rather than *dissotria*.

*M. pluvialis* reached a peak of abundance at Laniel in 1939 and 1940 and was practically absent in 1941 and 1942, thus following the same course as *M. dissotria*, possibly from the same causes. The degree of abundance in favoured situations may be judged by a count of nests made on a highway near Laniel. In a stretch 100 yards long and extending some thirty feet each side of the actual roadway, seventeen nests were counted on one side of the road and eighteen on the other.

Little is known of its enemies but the habit of hiding its cocoon under debris undoubtedly protects it from *Sarcophaga aldrichi* Park. which is one of the commonest parasites of the forest tent caterpillar. On the other hand, cocoons in such places are more subject to attack by small mammals and other terrestrial predators. The eggs also suffer from mammal attack; in 1940 fully half the clusters found had been more or less chewed by mice or shrews.

The present distribution of this species in eastern Canada is not known with any degree of exactness. Records of its occurrence in the Algoma district date back to 1911, and since 1937 it has been found from Sault Ste. Marie to Noranda and from Algonquin Park to Kapuskasing. Its future behaviour in this region will be a matter of considerable interest to students of insect cycles and distribution.

#### SOME ROBBER FLIES AND THEIR PREY

*Proctacanthus brevipennis* Wied. [C. T. Green]. Many of these robber flies were seen at Ranken, Missouri, on September 6, 1934. Several pairs were in copulo, and one was feeding upon a grasshopper, *Syrbula admirabilis* Uhler [A. B. Gurney].

*Protacanthus milberti* Macq. [C. T. Greene]. A female was observed August 14, 1932, feeding on a butterfly, *Anaea andria* Scud. [F. J. Benjamin], at Kirkwood, Missouri.

*Asilus* sp. [C. T. Greene]. This fly was feeding on the house fly, *Musca domestica* L. [J. M. Aldrich] at Kirkwood, Missouri, June 22, 1930.

*Erax aestuans* L. [C. T. Greene]. One individual was seen feeding on a fly, *Lucilia sericata* Mg. [J. M. Aldrich] at Kirkwood, Missouri, August 11, 1930.

*Atomosia puella* Wied. [C. T. Greene]. Individuals of this species were often seen during early June, 1930, about the clay bank in my yard which harbored several species of wasps and bees; their behavior indicated carnivorous habits. On June 14 I found one at rest on the bank with an unknown white larva in its mouth, and the next day I saw another one preying upon an hemipterous insect identified as *Plagiognathus* sp. [H. G. Barber].

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**SOME INSECTS INFESTING THE "SELENIUM INDICATOR"  
VETCHES IN SASKATCHEWAN\***

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It is known that selenium is highly toxic to mammals (1, 3) and to some insects (6, 8). Aphids cannot tolerate any appreciable quantities of selenium in host plants (4, 5, 10). A selenium content higher than 5 p.p.m. in cotton plants was reported toxic to cotton stainers (*Dysdercus howardi* Ballou) and to pink bollworm (*Platyedra gossypiella* Saund.) (6, 8). However, some dipterous adults, probably *Pseudotephritis*, were found to contain 20 p.p.m. and were thriving on foliage containing 1800 p.p.m. Dipterous larvae of probably the same species, from roots containing 190 p.p.m., had a selenium content of 7.5 p.p.m. (3).

Two vetches, the narrow-leaved milk vetch, *Cnemidophacos pectinatus* (Hook.) Ryd. (*Astragalus pectinatus* (Hook.) Dougl.), and the bisulcate milk vetch, *Diholcos bisulcatus* (Hook.) Ryd. (*Astragalus bisulcatus* (Hook.) A. Gray), occur commonly on the selenium-bearing cretaceous sediments of Saskatchewan. Analyses show that they have a high selenium content and for this reason are known as selenium "indicator" or "converter" plants (11). Roots of *C. pectinatus* contain from 57.5 to 969 p.p.m. The foliage of this species contains from 162 to 4190 p.p.m., with the foliage of *D. bisulcatus* running up to 3640 p.p.m. selenium (2, 11).

Both of these vetches are heavily attacked by two species of insects, *Anoplodera instabilis* Hald. (Cerambycidae) and *Walshia amorphella* Clem. (Cosmopterygidae). In Saskatchewan neither of these have so far been found breeding on other vetches, even those growing in the immediate vicinity of heavily infested plants of *C. pectinatus* or *D. bisulcatus*. However, it is interesting to note that Swaine and Hopping (9) report that *Pinus ponderosa* and other pines are the hosts of *A. instabilis*, and Dr. J. McDunnough (personal communication) reports that *W. amorphella* is supposed to be a gall-maker on false indigo. Larvae of *Anoplodera instabilis* Hald. are found in the roots of *C. pectinatus* and occasionally in the roots of *D. bisulcatus*. Selenium analysis of the infested roots of *C. pectinatus* showed from 154 to 969 p.p.m. A group of uninfested plants from the same location where larvae were found in plants having 969 p.p.m. contained only 57.95 p.p.m. Larvae of *Walshia amorphella* Clem. are very abundant in the roots of *D. bisulcatus* and occasionally in the roots of *C. pectinatus*. No analysis is available for the roots of *D. bisulcatus*, but the foliage of plants in areas in which this insect was collected ran up to 3640 p.p.m. selenium (2).

In the course of these observations a number of other insects were found in the roots or on the foliage of *C. pectinatus* or *D. bisulcatus* in such circumstances as to suggest that they may have a certain amount of immunity to selenium. The following larvae were found feeding in or on the roots of *C. pectinatus*: Elateridae, *Ludius aeripennis destructor* Brown and *Aeolus mellilus* Say; Curculionidae, *Brachyrhinus ovatus* (L.); Byrrhidae. Present but not observed feeding were: Coccidae; Tenebrionidae, *Eleodes* sp.; Xylophagidae; Muscidae, *Fannia* sp.; Chloropidae; Empidae. On the roots of *D. bisulcatus*, and probably feeding, were gelechiid larvae only. From the foliage of both vetches the following insects were found feeding: meloid adults, *Macrobasis subglabra* (Fall), *Lyta nutalli* Say and *Lyta viridana* Lec.; lycaenid larvae; mordellid larvae, probably *Mordellistena unicolor* Lec., tunnelling the stalks; Bruchidae, *Bruchus seminulum* Horn in seeds; probably *Bruchophagus*, near *gibbus* Boh., in seeds. Also present were mirid adults, *Hadroneura militaris* Uhl. attacking *Lyta nut-*

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talli; dermestid adults, *Attagenus piceus* Oliv., and curculionid adults, *Brachyrhinus ovatus* (L.).

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#### THE JACK PINE BUDWORM AND THE SPRUCE BUDWORM, *CACOECIA FUMIFERANA* CLEM. (TORTRICIDAE)\*

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During the past decade a severe outbreak of budworm has been in progress on jack pine in northwestern Ontario, following similar infestations in Michigan and Minnesota. It has been observed that budworm on jack pine does not spread to adjacent stands of balsam fir and spruce, and similarly that outbreaks on fir and spruce do not spread to adjacent jack pine stands. It was mainly this consideration which prompted Graham (1) to conclude that "the pine form is distinct biologically from the fir-spruce form and can be treated as a distinct species from the economic viewpoint." Graham's work has become widely known, but in spite of his conclusion, entomologists have still been referring to the jack pine budworm as *Cacoecia fumiferana*, while conceding that it may be a biological race of that species.

In the present paper we have brought together some morphological, biological, and distributional data which, in the opinion of the authors, constitute additional evidence in support of the theory that the jack pine budworm should be considered as either specifically or subspecifically distinct from *Cacoecia fumi-*

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*terana* Clem. While it is fully realized that a series of well planned breeding experiments is needed before a final conclusion can be reached, we feel that the observations presented here may be of value to any one contemplating work of this nature.

#### MORPHOLOGICAL CONSIDERATIONS

**Colour.** In Michigan, Graham (loc. cit.) noted that whereas the typical spruce budworm is "rather dull-coloured," the colour being variable, yet "in the pine form it is usually reddish-brown with silver markings". In Minnesota, A. C. Hodson (personal communication) reports that all specimens of the pine variety he has reared have been rusty-red and silver in contrast to the prevailing greyish-brown colour of those from spruce and balsam fir. The same observation has been made in northwestern Ontario (H. A. Richmond) and in other parts of Canada covered by the Forest Insect Survey.

The typical moth of the spruce budworm, reared from spruce or balsam, has the fore-wings of a dull colour, generally grey but occasionally grey-brown or reddish-brown; in all cases the lighter fasciae are dull and inconspicuous (Pl. 16, fig. a). The prevailing ground colour may be classed as *fuscous* (Ridgeway's Colour Charts), with an occasional fuscous-black, wood-brown or even cinnamon. These colours are all on the yellow side of spectral orange. The markings follow a certain general pattern but are rather poorly defined and very variable in detail.

The moth of the jack pine budworm, however, always shows the same colour, the pattern is well defined and shows only minor variations. The ground colour is always *burnt sienna* (Ridgeway), a bright spectral colour unshaded by any neutral grey, and containing a red component which the brown specimens of spruce budworm never attain. The fasciae in the jack pine budworm are a bright silver, slightly tinted with ochreous, and stand out definitely and conspicuously (Pl. 16, fig. b). The colour fades in old specimens.

**Size.** There is a constant and significant difference in wing-spread between adults of the jack pine budworm and of the spruce budworm reared under similar conditions. The jack pine budworm is considerable smaller. Measurements of the forewings show the following average length from base to apex:

Jack pine budworm. Males 9.3 mm. plus or minus 0.9 mm. Females 10.1 mm. plus or minus 1.1 mm.

Spruce budworm. Males 10.5 mm. plus or minus 1.0. Females 12.1 mm. plus or minus 1.2 mm.

**Genitalia.** There is a constant and significant difference in the size (Pl. 16, figs. c and d). This can be expressed in the case of the male genitalia as the distance between the base of the socii and the base of the vinculum. Preparations from six specimens of the spruce budworm and ten of the jack pine budworm yielded the following measurements:

Jack pine budworm, 1.54 m.m. plus or minus 0.18 mm.

Spruce budworm, 1.74 m.m. plus or minus 0.14 mm.

Independent of the difference in size as a whole, the uncus of the male genitalia was found to be significantly broader in the spruce budworm than in the jack pine budworm. Measurements of fourteen specimens of the former and ten of the latter gave the following widths of the uncus at its tip:

Jack pine budworm, 123 microns plus or minus 14 microns.

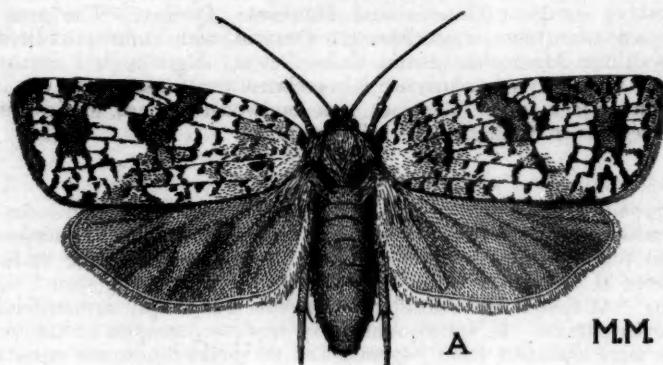
Spruce budworm, 192 microns plus or minus 25 microns.

These figures speak for themselves, the differences between the two forms being of the order of 52 per cent, as against 13 per cent for the size of genitalic structure as a whole.

#### GEOGRAPHIC DISTRIBUTION

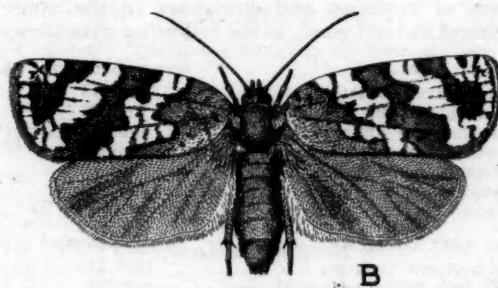
The spruce budworm extends from the Atlantic Ocean to the Pacific, and north almost to the limit of timber. In the United States it extends south to Oregon and Pennsylvania. The jack pine budworm has a known distribution

## PLATE XVI

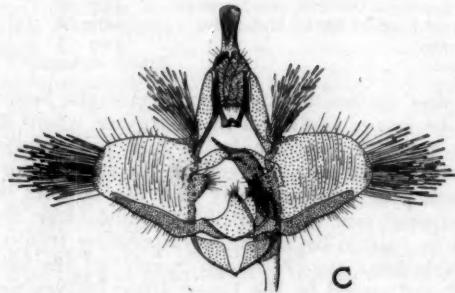


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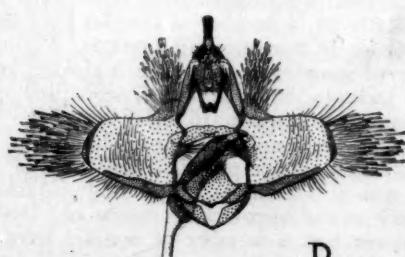
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D

SPRUCE AND JACK PINE BUDWORMS

at present limited to the interior of the Dominion, specimens not having been found east of southern Ontario and Maniwaki, Quebec. The area of the most frequent occurrence is northwestern Ontario, with more sporadic distribution in southern Manitoba, central Saskatchewan, Algoma, and southern Ontario. The frequency of occurrence is correlated very closely with the intensity distribution of jack pine. The jack pine budworm extends southward to the jack pine regions in Michigan and Minnesota.

#### BIONOMICS

*Seasonal development.* The larvae of the jack pine budworm are at present indistinguishable from those of the spruce budworm. However, it was noted that pupation and emergence in the case of the jack pine budworm in Kenora were at least three weeks later than in the case of the spruce budworm in Algoma. At first it was considered that this was simply a manifestation of difference in climate. In subsequent years, however, samples of the jack pine budworm were obtained from Algoma, and of spruce budworm from Kenora, and of both together from southern Ontario, thus giving an opportunity to compare the dates of pupation and emergence in the same localities. The differential was found to hold good, as the following data show.

Average Dates of Pupation	Spruce Budworm	Jack Pine Budworm
Deciduous Forest in southern Ontario .....	June 13	July 3
Great Lakes Forest in Ontario and western Quebec .....	June 23	July 7
Boreal Forest in northeastern Ontario .....	June 27	July 14
Boreal Forest in northwestern Ontario and Manitoba .....	June 28	July 15
Subalpine Forest on east slope of Rocky Mountains .....	June 19	July 5
In all areas in all years .....	June 25	July 12
Extreme range of dates .....	June 3 to July 26	June 16 to July 27
Average Dates of Adult Emergence	Spruce Budworm	Jack Pine Budworm
Deciduous Forest in southern Ontario .....	June 21	July 14
Great Lakes Forest in Ontario and western Quebec .....	July 3	July 18
Boreal Forest in northeastern Ontario .....	July 7	July 23
Boreal Forest in northwestern Ontario and Manitoba .....	July 9	July 27
Subalpine Forest on east slope of Rocky Mountains .....	June 30	July 15
In all areas, in all years .....	July 5	July 25
Extreme range of dates .....	June 6 to August 7	June 25 to August 17

The jack pine budworm pupates and emerges between two and three weeks later than the spruce budworm in all regions where it is distributed. It is also significant that the few samples of jack pine budworm collected and reared from spruce pupated and emerged on the same mean dates as jack pine budworm from jack pine; and similarly that the samples of spruce budworm from jack pine pupated and emerged on the same mean dates as spruce budworm from spruce or balsam fir, in the corresponding region.

*Host-tree Relationships.* Although nearly all the samples of jack pine budworm received and reared by the Forest Insect Survey were from jack pine, a few samples of this form were reared from other hard pines, and from white pine. More significantly yet, a number of samples have been reared from white spruce and black spruce in northwestern Ontario, Algoma, and southern Ontario. The number of samples of jack pine budworm reared from these tree species is as follows: jack pine 210, red pine 6, Scots pine 5, white pine 4, mugho pine 2, lodgepole pine 2, white spruce 16, black spruce 4.

The majority of the samples of spruce budworm were taken from the spruces and the firs, which are the principal host trees of this insect in Canada. However, tamarack also is sometimes considerably attacked by this species, as also is eastern hemlock in the Appalachian region and Douglas fir in the Pacific region. It is significant that a number of samples were obtained and reared from pines, including 22 from jack pine. Infestations of spruce budworm have occurred on white, jack, Scots and red pine at Midhurst, Ontario, and on jack

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pine at Sand Lake and Biscotasing, Ontario, and Riverton, Manitoba. The number of samples of spruce budworm obtained by the Forest Insect Survey on these tree species is as follows: white spruce 876, black spruce 111, red spruce 7, Engelmann spruce 35, Sitka spruce 1, Norway spruce 3, blue spruce 2; balsam fir 300, alpine fir 8; tamarack (larch) 2; Douglas fir 11; eastern hemlock 8; jack pine 22, white pine 20, red pine 4, Scots pine 2; Swedish juniper 1.

#### SUMMARY

Evidence is presented above that the differences between the spruce budworm and the jack pine budworm in size, wing coloration, geographical distribution, host relationships, and life-cycle dates are sufficiently significant and constant to set them apart as separate breeding stocks. The fine morphological characters, however, are similar with the possible exception of the shape of the uncus of the male genitalia. It is therefore submitted that the jack pine budworm may be considered as a subspecies of the spruce budworm, if not as a separate species. Controlled breeding experiments are needed to settle the question.

#### LITERATURE CITED

1. Graham, S. A. 1935. The Spruce Budworm on Michigan Pine, U. of Mich. School of Forestry, Bulletin No. 6.

#### NOTES AND DESCRIPTIONS OF NORTH AMERICAN GEOMETRIDAE (LEPIDOPTERA)\*

BY J. McDUNNOUGH,  
Ottawa, Ont.

#### *Eustroma semiatrata* Hlst.

*Cidaria nubilata* Packard, 1871, (nec Packard, 1867) Proc. Bost. Soc. Nat. Hist., XIII, 400.  
*Petrophora prunata* var. *nubilata* Packard, Mon. Geom., 118, Pl. VIII, fig. 46.

*Cidaria semiatrata* Hulst, 1881, Bull. Brook. Ent., Soc., IV, 26.  
*Eustroma nubilata* Barnes & McDunnough, 1918, Contr. Nat. Hist. Lep. N. Am., IV, (2), 137, Pl. XXI, fig. 2.

The name *nubilata* Pack. which has been generally applied to the species with black hair-pencil at base of primaries on underside and which was figured in the Barnes & McDunnough "Contributions", will have to be dropped as a homonym. It is preoccupied by *C. nubilata* Pack., 1867, Proc. Bost. Soc. Nat. Hist., XI, 48, proposed for a Labrador species; this name was later sunk by Moeschler (1870, Stett. Ent. Zt., 368), as a synonym of his *lugubrata*, an action concurred in by Packard (Mon. Geom., 118) who, however, wrongly transferred the name to another species in a varietal sense. Information kindly furnished by Dr. N. Banks, who has examined both of Packard's types in the Cambridge Museum, shows that Packard's Labrador male type is definitely a *Lygris* with the usual short brownish basal hair-pencil and that Moeschler's treatment of the species was probably correct.

Hulst's name, *semiatrata*, appears to be available to replace *nubilata* for the present species; I had a note in the "Contributions", Vol. III, (3) 175 to the effect that the locality-label on Hulst's type (Wash. Terr.) did not correspond with the text of the description which calls for "Colorado" as type locality. This was probably, however, merely due to careless transcription on the part of the author as other similar errors have been noted (*vide* B. & McD., Contr. IV (2), 138); the species occurs in both regions, and I should incline to accept Washington state as the type locality. In Colorado specimens the median band of primaries is scarcely as deeply blackish as in west-coast specimens nor are the

\*Contribution No. 2257, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

edges of the pale antemedian band quite as strongly dentate; in genitalia, however, I can detect no difference.

**Lygris destinata** Moesch.

The removal of the name, *nubilata* Pack (1867), to the *destinata* complex has caused me to make a rather careful study of the numerous names listed as either races or synonyms under this heading. As a result I believe that a number of changes must be made in our listing and I offer the following comments as representing my ideas on the subject. One of the chief factors in the past that has led to confusion has been the failure to recognize that the coloration of the females is frequently quite dissimilar to that of the males.

Typical *destinata* was described from Labrador and besides a male specimen sent by Bang-Haas of Dresden, Germany, which had been compared with Moeschler's type, we have a long series of males and three of the much rarer females from Hopedale, Labrador in our collection. Typical males show a purplish-brown basal area and median band, and grayish antemedian band and subterminal area on the primaries; at times the purplish tinges of the dark areas may be lacking and these areas are then a rather deep brown. There is a distinct *dark elongate-triangular patch* on outer margin of wing, margined costad by an irregular white streak; the small tuft on the scutellum of the metathorax is *concolorous* with the other thoracic vestiture; the *fore tarsi are dark smoky* with narrow, pale whitish or yellowish, terminal bands, similar central and apical bands being present on the tibia. Packard's figure in the Monograph (Pl. VIII, fig. 47) is a fair representation, although the antemedian band is narrower than is usually the case in the series before me.

The three females before me all show a *faint yellowish suffusion* in the pale areas and it is well to note that this yellowish suffusion, while not constantly present, may be considered as a *common female attribute*; in certain areas of distribution it becomes very marked and probably predominant.

In our Labrador series only very few of the males show the faintest traces of yellowish scaling but in four males from Cameron Bay, Great Bear Lake, two are *normal destinata* and the other two show definite yellowish suffusion; the same thing occurs in western forms which I am discussing later and is fairly satisfactory evidence that we are dealing merely with a color-form and not with a character that has racial value.

This leads us to *similis* Wlk. concerning which there is a note in the B. & McD. "Contributions", Vol. II (5) 205; *similis* was based ostensibly on a male from St. Martin's Falls, Albany River, N. Ont., but a photograph of the type kindly sent me by Mr. Tams, shows conclusively that it is a female, which brings it into line with the above remarks. *Remotata* Wlk., based on a male from the same identical locality, is evidently the normal gray-banded form and has been correctly sunk as a synonym of *destinata*. While I have seen no northern Ontario material, I doubt greatly that, when available, it will show any marked difference from Labrador *destinata* and would, therefore, refuse any racial value to *similis* but list it simply as a female color-form of the typical race.

Another color-variation appears to be represented by the name *lugubrata* Moesch., also described from Labrador, in which the pale areas of the primaries become suffused with the color of the basal and median areas and the whole wing appears practically unicolorous purplish or blackish-brown with the white bordering lines of the various areas more or less distinctly outlined. Originally described as a good species, and rather poorly figured, *lugubrata* was later (1877, Stett. Ent. Zt., 417) listed by the author as a dark form of *destinata*; *nubilata* Pack. had already been cited (1870, Stett. Ent. Zt., 368) as a synonym; I accept this as correct. While it is impossible at the present time to obtain any information regarding Moeschler's type of *lugubrata*, I have secured, through the cooperation of Dr. N. Banks, detailed information on Packard's *nubilata* type of

1867 from Labrador which bears out the above synonymy; particularly of note is the fact that the fore tibia and tarsi are of the same dark color with pale banding as I have stated under *destinata*; this eliminates from consideration a very similar suffused form of a general deep brown tint, quite prevalent in the Prairie Provinces and also occurring in Maine and eastern Quebec, in which the fore tarsi are evenly pale yellowish and the tuft on the scutellum is yellow-brown; such a form has very generally been determined as *lugubrata*. I have come across none of the suffused *lugubrata* form among my Labrador *destinata* but have several specimens among my western material, one of which (from Barkerville, B. C.) was designated by Dr. Banks as very close to Packard's *nubilata* type. As far as the present evidence goes *lugubrata* must be held as a suffused male form of *destinata* and not as a good species or race.

On the strength of a single topotypical male loaned me by Mr. J. Sperry I should consider *triangulata* Pack., based on material from Mt. Washington, N. H., as constituting a good race, apparently of rare occurrence. In the specimen before me the primaries are suffused with a characteristic dark russet-brown over the antemedian and subterminal areas, just as stated in the original description. The thoracic and abdominal vestiture is also of the same brownish shade. Of *montanata* Pack., generally considered to be merely the opposite sex of *triangulata*, I can say nothing; the type appears to be lost as it is not at Cambridge, according to Dr. Banks' statement.

In the west the species is not uncommon all through the Rocky Mt. region and several names have been proposed which, to my mind, have very doubtful racial value. *Schistacea* Warr. (1901, Nov. Zool., VIII, 468) was based on a single yellow-banded female from Boulder, Colo. I have examined a small series, kindly sent me by Mr. J. Sperry, of three males and one female from the adjacent Larimer Co.; the female shows the yellow banding and cannot be separated from my photo of *similis* type; the males are of the normal gray-banded form and, without locality-label, would, I am sure, be placed as *destinata*. Whether Colorado females are always yellow-banded remains to be seen when longer series are available; for the present *schistacea* may apply to a rather doubtful race of the Rocky Mts. of Colorado and adjacent regions.

*Griseata* C. & S., described as a good species from Wallace, Ida., (1922, Lepid., III, 161) and figured on p. 163, is another doubtful race. I have two male paratypes before me, both worn as is customary with so much of the Wallace material, and have examined a single female from the same locality, loaned me by Mr. Sperry. These all show a peculiar russet-brown shade in the dark areas; other male material from Moran, Wyo. (loaned by J. Sperry), including a specimen marked as having been compared with Cassino's type cannot be separated from the Colorado material under *schistacea*, certain specimens showing the tendency to yellow shading in the pale areas. Pending the receipt of more material I let the name stand in a racial sense; I can detect no genitalic differences in the male between *schistacea* and *griseata*.

*Bowmani* C. & S. was proposed (op. cit. p. 160) as a race of *lugubrata* for the form from the Alberta Rockies; it was based partially on material collected by myself at Nordegg and of which I have a long series of males, including paratypes. Considerable variation in maculation is shown by the series; in some specimens the gray antemedian and subterminal areas are quite distinct; in others these areas are partially or almost wholly obliterated by dark shading; the purple-brown median band may be evenly dark or it may show considerable central light shading; a few specimens show an appreciable tinge of yellow suffusion in the antemedian and subterminal areas. Thoracic tufting and color of legs is as in *destinata* and the only genitalic difference I can detect is a slight augmentation in the number of cornuti in the two subapical spine-clusters of the aedeagus, a feature common to all western material. The single female before me from Cadomin, Alta. (topotypical) is of the suffused type of maculation and

without yellow areas. Besides my Alberta material we have long series from the Hope Mts., B. C., and a small series from Barkerville, B. C., which fall here. The Hope Mt. material shows the same range of variation in the males as was noted in the Nordegg specimens. In the females, of which nine are before me, the variation ranges from gray-banded forms to those considerably tinted with yellow and in one specimen the median band is of the same russet-brown color as was noted under *griseata*. Should one name be considered sufficient for all these Rocky Mt. forms, then *schistacea* will have priority.

*Harveyata* Tayl. is probably the best defined of the so-called races. It is an inhabitant of the coastal areas of British Columbia and besides being of large size has apparently developed the yellow suffusion of the pale areas to a marked degree in both sexes. Our series, however, is too small to venture any statements regarding the stability of this character. The race probably extends down the Pacific Coast to California as a single very similar specimen from Del Norte Co., Calif. is before me.

I would propose the following revised listing of the species, noting again that vars. b, c and d might readily be sunk under one name.

4405 *destinata* Moesch.

*remotata* Wlk.

form ♂ *lugubrata* Moesch.

*nubilata* Pack.

form ♀ *similis* Wlk.

a *triangulata* Pack.

*montanata* Pack.

b *schistacea* Warr.

c *griseata* C. & S.

d *bowmani* C. & S.

e *harveyata* Tayl.

For the species wrongly identified as *similis* in its pale-banded form and as *lugubrata* in its suffused form a name is apparently needed. I am treating it as a species, in spite of practically similar male genitalia, on account of certain features of maculation which appear constant and which I am emphasizing in the following description.

***Lygris flavibrunneata* n. sp.**

**Male.** Similar in type of maculation to *destinata* but in general slightly smaller. Vestiture of thorax and abdomen a deep brown (varying somewhat in intensity of color) with a distinct yellow-brown tuft on the scutellum of the metathorax. On primaries the basal area and the median band are deep brown (the latter at times suffused with yellowish shading); the pale antemedian band which (in most cases) is more rectangularly angled below the costa and narrower than in *destinata* shows considerable pale yellow suffusion and a similar color occurs in the subterminal area. The terminal area is brown (of various shades), considerably suffused with gray scaling along outer margin, especially in lower half of wing; there is the usual, once-angled, oblique, white line from apex of wing inward, but this is not followed by the large dark triangular patch on outer margin found in *destinata*, being merely narrowly margined on lower side by dark brown. Secondaries rather dark smoky with obscure median line, well-developed postmedian line, strongly dentate in lower half, and obscure subterminal smoky lunules.

**Fore tarsi** and to a great extent, tarsi of other legs, entirely pale yellowish; tibiae also with considerable yellowish suffusion.

**Female.** The single female before me shows on primaries a paler brown color in basal and median areas and in general more yellowish suffusion. This is probably merely individual and more material of this sex will doubtless show a considerable range of color-variation. Expanse 28-30 mm.

*Holotype* — ♂, Lloydminster, Alta., Aug. 10, 1942 (P. Bruggemann); No. 5444 in the Canadian National Collection, Ottawa.

*Allotype* — ♀, Edmonton, Alta., Aug. 25, 1916.

*Paratypes* — 5 ♂, same data as Holotype; 7 ♂, Sunnydale, Alta., Aug. 9, 10, 14, 16, 1941 & 42 (P. Bruggemann); 3 ♂, Edmonton, Alta., Aug. 10, 1914; 2 ♂, Harlan, Sask., Aug. 10, 11, 1940 (A. R. Brooks); 2 ♂, Indian Head, Sask., Aug. 22, 27, 1924 (J. J. de Gryse); 1 ♂, Miniota, Man., July 10, 1932 (N. Gibbon). Some of these are deposited in Coll. Bruggemann, Coll. Sperry and Museum of Comparative Zoology, Cambridge, Mass.

A suffused form of this species occurs not infrequently along with the normal form; in this the primaries are entirely suffused with a deep, rich brown color, crossing which the white irregular lines forming the margins of the antemedian band and the outer margin of the median area show up quite prominently. For this I propose the name form *UNICOLORATA* form. nov.

*Holotype* — ♂, Lloydminster, Alta., Aug. 9, 1942 (P. Bruggemann); No. 5445 in the Canadian National Collection, Ottawa.

*Allotype* — ♀, Saskatoon, Sask., Aug. 25, 1924 (K. M. King).

*Paratypes* — 6 ♂, same data as Holotype, Aug. 10 (ex Coll. Sperry); 1 ♂, Indian Head, Sask., Aug. 27, 1924 (J. J. de Gryse); 1 ♂, Saskatoon, Sask., Aug. 12, 1924 (K. M. King); 2 ♂, Miniota, Man., July 4, 1934, June 28, 1942 (H. Gibbon); 1 ♀, Transcona, Man., Aug. 4, 1935 (S. S. Brooks).

The species also occurs rarely in the east. There is in our collection a single male of the typical form from Granby, Que., and a female from Cascapedia, Que.; also a ♂ of form *unicolorata* from Rimouski, Que. I have examined several males from the Brower Coll. taken by C. F. dos Passos at Rangeley, Maine and there are other Maine specimens in the Museum of Comparative Zoology at Cambridge, Mass.

In the male genitalia the two spine-clusters in the aedeagus seem somewhat longer than those of *destinata*, especially than those of Labrador material; otherwise I can point to nothing in this organ that can be satisfactorily used to separate the species.

#### *Lygris xylinna* Hlst.

In the Check List (1938), *speciosa* Hlst. was placed as an aberration of *xylinna*. It would be better, I believe, to follow the note in the B. & McD. "Contributions" Vol. III (4) 226 and use *speciosa* in a varietal sense for the race occurring throughout the Rocky Mt. region with shorter pectinations in the male antennae than in *xylinna* and with the median band on primaries decidedly purplish-brown as compared with the rather bright brown of *xylinna*. The type of *xylinna*, as already noted, is labelled "N. Y." but I know of no other specimens from this region: the specimens in our collection that match in antennal length and in coloration are all from Vancouver Is., B. C. Taylor was evidently also dubious (*vide* Dod, 1906, Can. Ent., 92) as to the locality label.

I can detect no genitalic differences between the two races; *serrataria* B. & McD., however, was separated in the Check List as a good species. The aedeagus is longer and thinner than in *xylinna* and the size and arrangement of the two spine-clusters in the vesica are different. Incidentally, I have my doubts that the species figured by Cassino (Lepid. III, 103) as *serrataria* is this species; it looks to me more like *speciosa*.

#### *Dysstroma rutlandia* n. sp.

Belongs in the *hersiliata* group and is very similar in maculation to the variety *manitoba* McD. but is at once distinguished by its deep smoky secondaries.

Palpi and head smoky brown with slight peppering of white scales. Thorax with considerable burnt-orange suffusion, especially in ♀. Abdomen smoky with moderately distinct transverse banding on posterior portions of seg-

ments (much more evident than in *manitoba*). Primaries with basal, median and terminal areas deep blue-gray, much as in *manitoba*. Antemedian band slightly wider than in *manitoba* but only half the width of that of *hersiliata*; in color a deep burnt-orange, paling in costal area and narrowly margined with light ochreous, giving the appearance of an upright bar of color as in related species. The inner edge of this antemedian band is more or less upright with a slight incurve at costa; the outer edge is upright or slightly concave from inner margin to cubitus where it forms a weak angle and runs practically perpendicular to costa. The median band is nearly solid with faint paling centrally and traces of crosslines near inner and outer margins; a distinct black discal streak is present; the outer edge, bordered by a thin whitish line, bulges much more prominently between veins 3 and 5 than in *manitoba* and lacks the prominent pointed inward indentation opposite the discal streak found in *hersiliata* and *manitoba*, being merely feebly notched at this point. The subterminal area, especially in costal area is deep burnt-orange, paling next median band and is bordered outwardly by the usual prominent, crenulate, whitish, s. t. line. A black dash extends obliquely and irregularly inward from below apex of wing to s. t. line. Termen with the usual small, black, paired dots and broken marginal line. Fringes concolorous.

Secondaries deep smoky with traces of a small dark discal dot and a curved and slightly crenulate postmedian line, edged faintly outwardly with paler shading. Termen as on primaries. Beneath primaries to postmedian line light smoky with distinct dark discal streak; postmedian line much as on upper side; beyond pale ochreous with slight orange tinges in costal area. Subterminal line very faint, defined on costa by a pale vertical dash. Terminal area, especially at costa, with white sprinkling over a smoky background, giving a general grayish appearance. Secondaries light ochreous sprinkled with smoky, with discal dot and postmedian line of upper side repeated, the latter rather sharply bent toward inner margin on vein 3. Traces of small subterminal smoky blotches, strongest above inner margin. Expanse 23-25 mm.

*Holotype* — ♂, Rutland, Sask., July 15, 1940 (A. R. Brooks); No. 5448 in the Canadian National Collection, Ottawa.

*Allotype* — ♀, same data, July 25.

*Paratypes* — 1 ♂, 1 ♀, same data, July 16, 20.

In the male genitalia the main distinction is, as usual, found in the spine-cluster of the aedeagus; this is long and thin, occupying nearly half the length of the aedeagus, composed of fine cornuti, arranged in a closely appressed, vertical row (in *manitoba* the cluster is shorter and chunkier).

Corresponding to the form *infumata* of *manitoba*, a form of the species occurs in which the orange color of thorax and antemedian and subterminal areas of primaries is replaced by smoky sprinkling with a narrow blackish bar along inner margin of antemedian band, not attaining costa. The outer area of this band, as well as the subterminal area shows shading of a deep mahogany brown. For this form, which might readily be confused with small *boreata* Tayl., I propose the name *PERFUSCATA* form. nov. my holotype and allotypes being male and female from same locality as the typical form, July 15 and 27, 1940 (A. R. Brooks); No. 5449 in the Canadian National Collection, Ottawa.

#### *Hydriomena catalinata* n. sp.

Belongs in the *furcata* group on genitalic characters and has much the appearance of some of the darker forms of this species.

*Male*. Palpi moderately short, very slightly longer and less bushy than in *furcata*, rather deep smoky. Front pale ochreous anteriorly, sprinkled with smoky posteriorly with vertex of head showing a faint brownish tinge. Antennae rather thin and laterally compressed as usual. Thorax clothed with an admixture of ochreous and light brownish scaling with a couple of blackish

streaks on the patagia; tuft on scutellum of metathorax largely composed of blackish scales. Primaries with the usual 5 crossbands of a dark purplish or liver-brown, the paler intermediate portions of the wing being of a pale ochreous with a slight pinkish tinge and heavily sprinkled with smoky atoms, the whole color being much the same as that of *barnesata* Swett but scarcely as contrasting. The first dark band (subbasal) angles outward slightly below costa and then broadens, continuing almost perpendicular to inner margin; the second band (antemedian) is very broad except at costa, in general parallel to the first band, with a strong outward angle (especially of its outer border-line) in the cell; the outer border is somewhat suffused with smoky, partially connecting it with the third, narrow, subparallel, median band which in its turn sends dark shades down the disocellular and along veins 3 and 4 to connect with the fourth band (postmedian), more or less enclosing a quadrate costal blotch of paler color; the fourth band is moderately broad in the costal half of wing but narrows to a mere crenulate line above inner margin, passing through a rather broad area of the paler color. The fifth band (submarginal) is very broad, its black outer edge angled outwardly below costa and then irregularly dentate and close to outer margin of wing; the inner edge shows a blackish shade opposite cell and just below this, between veins 3 and 4 is a large whitish spot. A short blackish oblique streak connects the apex of wing with the outer edge of the fifth band. The outer margin of wing shows the usual row of paired black streaks and the fringe is concolorous slightly checkered by smoky. Secondaries deep smoky-brown, deepening in color outwardly, with traces of a smoky discal dot and curved postmedian line showing through from underside. Beneath primaries heavily suffused with smoky in central portion of wing with costa pale, cut by a dark curved postmedian band and a broad antecapital shade. Secondaries dull dirty whitish with distinct dark discal spot and evenly curved postmedian line; outer area broadly, but rather obscurely shaded with smoky, forming a darker band separated from the postmedian band by a curved band of the lighter ground-color.

*Female.* Very similar to male but larger and with the cross banding of primaries more distinctly defined. Expanse, ♂, 32 mm.; ♀, 39 mm.

*Holotype* — ♂, Santa Catalina Mts., Ariz., 15.VIII.1938 (Bryant, Lot 21); No. 5446 in the Canadian National Collection, Ottawa.

*Allotype* — ♀, same data but 15.VI.1938 (VI, possibly in error for VIII or vice versa).

In the male genitalia the uncus is very broad with convex sides beyond the short, broad neck, terminating in short points; apex with broad, shallow, V-shaped incision; on the whole closer to *quinquefasciata* than to *furcata*. The chitinized costal portion of clasper is broad and heavy, projecting in a blunt point well beyond the membranous section. The transtilla form two broad, heavily chitinized, blade-like projections, pointed apically (much stronger than in either *furcata* or *quinquefasciata*). The aedeagus is much longer than in the allied species, the apical section broadening into a trough, the sides of which are clothed with hair-like scales. Although apparently quite similar to *regulata* Pears. — which is only known to me by the figure in the B. & McD. Contr., Vol. IV, Pl. VI — it cannot be this species as the palpi are quite short and the dorsal metathoracic tuft is not of the large striking nature mentioned by Pearsall in the original description.

#### *Hydriomena bryanti* n. sp.

Belongs, according to the short palpi and simple uncus, in the *albifasciata* group, although the shape of the uncus is closer to that of *barnesata* in the "long palpi" group; this only goes to confirm the opinion expressed on page 34 of the B. & McD. revision that the *albifasciata* and *speciosata* groups, in spite of difference of palpal length, are probably closely related.

**Male.** Palpi quite short, rather thin, black-scaled, with pale base. Antennae thin, laterally compressed as usual. Head, collar and thorax pale greenish-white, the collar with lateral black edging and each patagium with a basal and subapical black spot. Metathoracic tuft small, blackish. Primaries a pale whitish green, lightly peppered with smoky atoms and crossed by the usual five lines and bands of blackish or purple-brown. Extreme base of wing with slight blackish shading. Subbasal line forming a small dark blotch on costa, otherwise thin and rather obscure, angled outwardly in cell and then more or less perpendicular to inner margin, ending in a black streak extending along inner margin from near base almost to antemedian band. The second band (antemedian) is very broad and irregular, deep purple-brown in color; its general course is outwardly oblique and its outer edge forms an outward angle in cell and an inward one in the submedian fold. The third line, starting from a triangular dark blotch on costa, is closely approached to the preceding band but is merely a broken and obscure line for the remainder of its course. The broad, pale greenish median and postmedian areas show a light ruddy shading in the fold. The fourth, irregularly outwardly oblique, postmedian line is only prominent in the costal half of wing, forming a slight indentation in the cell and indications of a strong outward bulge below this; its ending on the inner margin is indicated by an upright bar of blackish, close and parallel to a similar bar indicating the third line. On the disk of the wing the pale median and subterminal areas merge. Fifth band (subterminal) very broad and purple-brown from costa to vein 4 with inner edge partially blackish and outer edge strongly dentate; then by an outward bulge of the inner edge the band is considerably narrowed as far as vein 2, below this again expanding to form a tornal blotch. Apex of wing with small dark blotch and outer margin with a series of small dark spots. Secondaries dirty whitish in basal half, suffused with smoky outwardly to form a broad terminal band. Beneath primaries light smoky, costa with several pale ochreous patches, the most prominent being subterminal and followed by a broad dark shade indicating the subterminal dark band up upper side. Secondaries dull whitish, without discal dot, and only faintest indications of postmedian and subterminal parallel lines. Expanse 29 mm.

**Holotype** — ♂, Santa Catalina Mts., Ariz., 20.VIII.1938 (Bryant, Lot 21); No. 5447 in the Canadian National Collection, Ottawa.

**Paratype** — 1 ♂, Arizona (O. Bryant).

In the male genitalia the uncus is simple, long and strap-like. The costal edge of clasper is strongly chitinized, projects well beyond the membranous portion and terminates in a long, thin, slightly curved hook. The aedeagus is of moderate width and length, considerably narrowed in its proximal third and armed with a single, long, thin spine, fully half the length of the organ; there is also a cluster of ten or so smaller spines, closely approximated to the large spine in its apical half, which gradually decrease in length toward apex of aedeagus.

#### **Hydriomena clarki** Wgt.

In the 1938 Check List this was doubtfully placed as a synonym of *morsata* B. & McD. Since then I have received two specimens from the type locality, Sta. Catalina Mts., Ariz., which agree well with Wright's excellent description and prove that *clarki* is a perfectly good species, at once separated from the *speciosata* group by the short palpi and very evidently closely allied to the preceding species. Apart from the much darker coloration of both fore and hind wings *clarki* may be separated from *bryanti* on male genitalic characters. The uncus is considerably longer and thinner; the hook-like termination of the chitinized costal section of the clasper is bent at right angles; the armature of the aedeagus consists of a row of only four spines, each one shorter than the preceding and the longest one considerably shorter than the long spine found in *bryanti*.

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